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“ monſtroſa hæc bina corpora duplici mente ac ſpi-
 “ ritu regantur. Nam five cor faciamus, five cere-
 “ brum ſtatuamus animi ſedem, ex utrolibet idem
 “ nullo negotio evincitur. Adde tot actiones multi-
 “ plices, cogitationes rerum diverſas, ſenſa animi varia,
 “ quæ, ut aliud nihil fit, iſthuc pariter nos docent.
 “ Unum præcipuè hic admirandum venit, quod
 “ commemorare ſuperiùs memoriâ excidit; poſt
 “ prodigioſum videlicet hunc difficilemque partum
 “ natos eſſe matri alios liberos, ex eodem patre pro-
 “ creatos, ſanos et valentes, corpore, ſpecie ac forma
 “ integros, qui monſtri nihil admixtum habeant.”

XL. *Observations on the Origin and Uſe of
 the Lymphatic Veſſels of Animals: being
 an Extract from the Gullſtonian Lectures,
 read in the Theatre of the College of Phy-
 ſicians of London, in June 1755. By
 Mark Akenſide, M.D. Fellow of the College
 of Phyſicians, and of the Royal Society.*

Read Nov. 10, 1757. **I**T is proved, by a multitude of expe-
 riments, that the lymphatics com-
 municate with the blood-veſſels. They may be
 diſtended by blowing air, or by injecting water or
 mercury, into an artery: and the lymph, which
 they carry, is frequently, in a morbid ſtate, found
 tinged with a mixture of the red globules or craſſa-
 mentum of the blood. Upon this foundation two
 different

different theories have been raised, concerning the connection of the lymphatics with the arteries.

Of these, we shall first consider that of the late famous professor Boerhaave. He observed, that every artery of the body is greater, in its diameter, than any of its branches : and this observation being found true, as far as our eye and the microscope can inform us, he inferred, by analogy, that it held good even thro' the most minute subdivisions of the arterial system. But, says he, proportionable to the diameter of the canal is the size of the particles moving thro' it : therefore, if an ultimate capillary artery, admitting only one red globule at once to pass thro' it, send off lateral branches, these branches will be capable of receiving such particles only as are smaller than a red globule. But the particles next in magnitude below the red globules are the yellow serous ones ; and the lateral vessel, thus receiving them, is a serous artery, and the trunk of a second order of vessels. In like manner, this trunk, being continued on thro' many lessening branches, will at last grow so minute, as to admit only one serous globule : its lateral branches, therefore, will receive only such particles as are smaller than the serous ones : but these are the particles of the lymph ; and this lateral branch is a lymphatic artery, and the trunk of a third order of vessels. Thus, in the red arteries are contained all the circulated fluids of the body ; in the serous arteries, all except the red blood ; in the lymphatics, all except the red blood and serum : and this subordination is, according to the same laws, continued down thro' fluids more subtile than the lymph, to the smallest vessel, which is propagated from the aorta.

Such was Boerhaave's doctrine concerning the vascular system of animal bodies; like many of his other notions, ingenious, plausible, and recommending itself, at first sight, by an appearance of geometrical and mechanical accuracy: but founded upon insufficient data, and by no means to be reconciled to appearances.

For, in the first place, should we admit his hypothesis, it is certain, that the conical or converging form of the aorta, and the change of direction in its branches, must, in the distant blood-vessels, occasion a great resistance to the moving blood, and a great diminution of its velocity. Suppose that this resistance be, in any capillary red artery, to the resistance in the trunk of the aorta, as any larger assignable number is to unit: the resistance, then, in a capillary serous artery will, to that in the aorta, be as the square of that number is to unit; in the capillary lymphatic; as the cube; and so in progression: that is, the velocity of the fluids, in the remoter series of vessels, will be, physically, nothing. But we know, on the contrary, that some very remote series of vessels have their contents moved with a very considerable velocity; particularly the vessels of the insensible perspiration: and in anatomical injections, the liquor thrown into an artery scarce returns more easily or speedily by the corresponding vein, than by the most subtile excretory ducts. Moreover, there are an infinite number of observations of morbid cases, in which the red blood itself has been evacuated thro' some of the most remote series of vessels, merely from an occasional temporary obstruction in one part; or a præternatural laxity in another; and without
any

any lasting detriment to the structure and subordination of the vessels ; which yet, upon this hypothesis, must have been utterly destroyed before such an irregularity could have happened.

The other theory concerning the origin of the lymphatics has been maintained by some very eminent physiologists later than Boerhaave ; and supposes, that these vessels receive their lymph from the blood-vessels, or from the excretories of the larger glands, by the intermediation of only one small vessel, which these authors term a lymphatic artery, invisible in its natural state, nor yet rendered subject to the senses by experiments. But to this it may be answered, that the lymphatics are traced into many parts of the body, and lost there ; and therefore most probably have their origin there, where no large gland nor blood-vessel is to be found in their neighbourhood : that it contradicts the whole analogy of nature, to suppose the motion of an animal fluid more discernible in the veins than in the arteries : and, finally, that it seems rather an instance of want of thought, and of being imposed upon by words, to call the lymphatic vessels veins, because they are furnished with valves ; and then, because they are called veins, to take for granted, that of course they must be the continuation of arteries.

In attempting to investigate matters too subtle for the cognizance of our senses, the only method, in which we can reasonably proceed, is by inferring from what we know in subjects of the same nature : and our conclusion thus inferred, concerning the subject sought, will be firmer and more unquestionable, in proportion as it resembles the subject known. But
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if the subjects be really of the same kind; if no difference can be shewn between them, in any respect material to the inquiry, in which we are engaged; in this case our inference from analogy becomes the very next thing to a physical certainty: and this I apprehend to be true in relation to the problem before us, concerning the origin of the lymphatic vessels. Tho' in general we cannot, by experiments, arrive at the extremities of those tubes, nor satisfy ourselves, by inspection, in what manner they receive their fluid; yet in a very considerable number of them we can do both. There is a certain part of the human body very abundantly provided with lymphatics; in which part we can actually force injections thro' those vessels into a cavity, where their extremities open: and from this cavity, on the other hand, we can at pleasure introduce a coloured liquor into their extremities, and trace it from smaller into wider canals; from capillary tubes, without valves, into large lymphatic trunks copiously furnished with them. We know likewise, that into this cavity are continually exhaling an infinite number of watery and mucous vessels, both arterial tubes and excretory ducts: that these keep it moist with a perpetual vapour, which the extremities of those lymphatics are, in the mean time, perpetually imbibing. Does it not seem strange, while these particulars are known and acknowledged by all the world, that the great authors of anatomy and physiology should never have reasoned from them; but should run into complex and obscure suppositions, in order to explain a process, which they may at any time examine with their own eyes? But perhaps this inadvertency may be accounted

accounted for, if we recollect, that at the time when these vessels, and the structure of this part, were discovered, the lymph, and every thing belonging to it, was utterly unknown; and that the vessels in question were first seen and considered as performing another and more remarkable office: which circumstance, it should seem, has prevented succeeding authors from being duly attentive to them in the capacity of lymphatics. However this be, it is certain, that the lymphatics of the mesentery, commonly called the lacteals, differ from those of the other parts in no one particular, save that occasionally they carry chyle instead of lymph; or rather carry lymph mixed, at stated times (that is, for two or three hours after the creature has taken food) with an emulsion of vegetable and animal substances, and coloured white by that mixture. At other times, (that is, during sixteen or eighteen hours out of the twenty-four) they contain nothing but lymph; and are, in every respect, mere lymphatic vessels, not to be distinguished from those in any other part of the body. Their structure is the same; the membrane of which they are formed, their valves, the lymph which they contain, the glands thro' which they pass, their direction from smaller tubes to larger, and from these to the blood, differ in nothing from what we observe of the other lymphatics. Their lymph, in the mean time, is without doubt or controversy supplied from the cavity of the intestines; being the watery moisture continually exhaled there for the purposes of digestion, and for the preservation of the alimentary canal, and as continually taken up by the roots or extremities of these vessels, in
order

order to be carried back to the blood, after it has performed its office in the bowels. Let it also be remembered, that these vessels, in other places of the body, are generally, when we trace them, lost in muscular, tendinous, or membranous parts: and then, I should presume, it may fairly, and with a good degree of evidence, be concluded, that the lymphatics of the body, in general, have their origin among the little cavities of the cellular substance of the muscles, among the mucous folliculi of the tendons, or the membranous receptacles and ducts of the larger glands: that their extremities or roots do, from these cavities, imbibe the moisture exhaled there from the ultimate arterial tubes, just as the lacteals (the lymphatics of the mesentery) do on the concave surface of the intestines: and that the minute imbibing vessels, by gradually opening one into another, form at length a lymphatic trunk, furnished with valves to prevent the return of its fluid, and tending uniformly, from the extremities and from the viscera, to reconvey to the blood that lymph, or that fine stream, with which they are kept in perpetual moisture; a circumstance indispensibly necessary to life and motion: while, at the same time, the continual re-absorption of that moisture by the lymphatics is no less necessary, in order to preserve the blood properly fluid, and to prevent the putrefaction, which would inevitably follow, if this animal vapour were suffered to stagnate in the cavities where it is discharged.